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NACOBBUS (Nematoda: Tylenchidae)

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ANNOTATED BIBLIOGRAPHY NO. 18

COMMONWEALTH INSTITUTE OF HELMINTHOLOGY



—Proceedings of the Helminthological Society of Washington.

1. THORNE, G. & ALLEN, M. W., 1944.—“*Nacobbus dorsalis*, nov. gen. nov. spec. (Nematoda: Tylenchidae) producing galls on the roots of alfalfa, *Erodium cicutarium* (L.) L’Her.” 11 (1), 27–31.

- 253—CHITWOOD, B. G. & CHITWOOD, M. B., 1950.—“An introduction to nematology. Section I. Anatomy.” Washington, D.C.: B. G. Chitwood, viii+213 pp. [Revised edit.]

In this revised issue of Section I of “An Introduction to Nematology” the subject matter is dealt with in 13 chapters as follows: 1. Introduction; 2. General structure of nematodes; 3. The external cuticle and hypodermis; 4. Somatic musculature; 5. Cephalic structures and stoma; 6. Oesophagus and oesophago-intestinal valve; 7. The intestine or mesenteron; 8. The posterior gut; 9. The excretory system; 10. The reproductive system; 11. The nervous system; 12. Nemic ova; 13. Nemic relationships. The introductory chapter contains an outline classification in which the following new names are defined: *Pristionchinae* n.subf., *Drilonematoidea* n.superf., *Drilonematinae* n.subf., *Pharyngonematinae* n.subf., *Ungellidae* n.fam., *Nacobbinae* n.subf., *Dolichodorinae* n.subf.

T.G.

132—Proceedings of the Helminthological Society of Washington.

1. THORNE, G. & SCHUSTER, M. L., 1956.—“*Nacobbus batatiformis*, n.sp. (Nematoda: Tylenchidae), producing galls on the roots of sugar beets and other plants.” 23 (2), 128–134.

(133i) *Nacobbus batatiformis* n.sp. was found on sugar-beet in Nebraska, causing galls like those due to *Meloidogyne*. It also occurs on sugar-beet in Colorado and Wyoming. In tests of 74 plant species in 15 families, 30 species in 9 families became infested. All tested species were susceptible in the *Chenopodiaceae*, *Cruciferae*, *Cactaceae* and *Zygophyllaceae*; all tested were non-susceptible in the *Gramineae*, *Liliaceae*, *Malvaceae*, *Iridaceae*, *Amaranthaceae* and *Convolvulaceae*. Of nine species tested in *Leguminosae* only *Pisum sativum* was infested. In *Solanaceae*, tomato and egg-plant were infested but pepper and potato were not. Larvae enter the small roots of sugar-beet, feed and undergo two moults and leave the roots as pre-adults. At least some make a final moult in the soil, becoming males or young, active females. The latter move to larger roots and establish themselves with the head near the central cylinder. The surrounding cells enlarge and a gall develops. The female swells but the posterior part is extended towards an opening on the surface of the root where eggs are discharged into a gelatinous matrix. *N. batatiformis* differs from *N. dorsalis* in that the mature female is spindle-shaped or irregular rather than spheroid anteriorly with a slender, elongated posterior region. The infective female has the distance between vulva and anus about equal to the tail length, whereas it is three times the tail length in *N. dorsalis* and twice in *N. aberrans*. The male tail is about as long as the anal body diameter as compared with $1\frac{1}{2}$ times as long in *N. dorsalis*. *N. batatiformis* differs from *N. aberrans* in that the adult female has a much more strongly developed median oesophageal bulb and corpus and in the infective female the phasmids are near the middle of the tail instead of near the tip.

M.T.F.

436—Journal of the American Society of Sugar Beet Technologists.

- a. THORNE, G., 1956.—“Effects of sugar beet root diffusates and extracts, and other substances, on the hatching of eggs from the cysts of the sugar beet nematode, *Heterodera schachtii* Schmidt.” 9, 139–145.
- b. SCHUSTER, M. L. & THORNE, G., 1956.—“Distribution, relation to weeds, and histology of sugar beet root galls caused by *Nacobbus batatiformis* Thorne and Schuster.” 9, 193–197.

(436b) *Nacobbus batatiformis* was found in 32% of sugar-beet fields sampled in western Nebraska, in sandy soils north of the North Platte river but not in the silt soils south of the river. It reduces the stand and vigour of sugar-beet. It occurs on three native cacti and on *Chenopodium album* and *Kochia scoparia* and is considered to be native to the region. It is probably spread in irrigation water. A histological description is given of the galls formed in infested sugar-beet.

M.T.F.

- 1351—FRANKLIN, M. T., 1959. [Rothamsted Experimental Station, Harpenden, Herts, U.K.] “*Nacobbus serendipiticus* n.sp., a root-galling nematode from tomatoes in England.” *Nematologica*, 4 (4), 286–293. [German summary p. 293.]

Nacobbus serendipiticus n.sp. caused galling of the roots of tomatoes in a glass-house in Berkshire. The mature females are irregularly spindle-shaped, without an elongated posterior region, and have a well developed oesophageal corpus and muscular bulb. The stylet is $19\text{--}22\mu$ with conspicuous knobs. The males are slender with tylenchoid spicules and a small bursa surrounding the tail which is about as long as the anal body diameter. The newly hatched larvae have blunt tails with phasmids midway and the lateral field has four incisures.

M. T. Franklin



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251—GRAHAM, C. W., 1958. "A nematode genus new to Europe." *Plant Pathology*, 7 (3), 114. This briefly reports the presence of *Nacobbus* sp. causing galls on tomato roots from Wokingham, Berks. Photographs of galled roots and of an adult female are given. J. B. Goodey

1689—SCHUSTER, M. L. & SULLIVAN, T., 1960. "Species differentiation of nematodes through host reaction in tissue culture. I. Comparisons of *Meloidogyne hapla*, *Meloidogyne incognita incognita*, and *Nacobbus batatiformis*." *Phytopathology*, 50 (12), 874-876.

Individual larvae of *Meloidogyne hapla*, *M. incognita* or *Nacobbus batatiformis* were placed 3 mm. from the tips of tomato roots growing under sterile conditions in agar medium. Consistent differences were observed in the symptoms caused by the three nematode species. In the presence of *M. incognita* root hairs were not formed on the gall, particularly when the gall was on or near the agar surface, and the epidermal cells appeared square in outline. With *M. hapla* root hair development was greater on the galls than on the adjacent root surface and the epidermal cells resembled those in *M. incognita* galls. Galls induced by *N. batatiformis* had no root hairs and the epidermal cells became almost spherical. This species also caused necrosis. All species caused galls by surface feeding as well as when they entered the roots. The technique used is suggested as a means of differentiating *Meloidogyne* species which would be supplementary to morphological differentiation. M. T. Franklin

850—LORDELLO, L. G. E., ZAMITH, A. P. L. & BOOCK, O. J., 1961. "Two nematodes found attacking potato in Cochabamba, Bolivia." *Anais da Academia Brasileira de Ciencias*, 33 (2), 209-215.

Nacobbus serendipiticus boliviensis n.subsp. and *Pratylenchus andinus* n.sp. are described and figured; they were both obtained from the roots of varieties of *Solanum andigenum*, *Solanum* sp. and hybrids. *N. serendipiticus boliviensis* is distinguished from *N. serendipiticus serendipiticus* Franklin, 1959 by the central band of the lateral field being narrower than the outer ones and in the greater body width of the males. Some histological observations were made on the galls produced by *N. serendipiticus boliviensis* on the roots of *S. andigenum*; these are small, having a diameter 2 to 3 times that of a normal root. *P. andinus* n.sp., female, has a lip region with 3 annules and a rounded tail terminus without annulations. It most closely resembles *P. penetrans* from which it differs by the ovary extending to the oesophageal glands and in the absence of a spermatheca. D.J.H.

2745—SCHUSTER, M. L., SANDSTEDT, R. & ESTES, L. W., 1964. "Starch formation induced by a plant parasitic nematode." *Science*, 143 (3612), 1342-1343.

Starch granules are described from the syncytia induced in plant roots by the feeding of *Nacobbus batatiformis*. They are formed soon after the nematode enters a root when the nuclei and nucleoli are beginning to enlarge before hypertrophy of the cells leading to formation of the syncytium. During reproduction of the nematode the amount of starch decreases. Plants in which starch granules were found include *Beta vulgaris*, *Spinacia oleracea*, *Opuntia tortispina*, *Kochia scoparia*, *Lycopersicon esculentum*, *Chenopodium album*, *Portulaca oleracea* and *Euphorbia maculata*. Male as well as female *Nacobbus* appear to induce gall and starch formation. M.T.F.

2047—SCHUSTER, M. L. & SANDSTEDT, R. 1964. "The parasitic behaviour of *Nacobbus batatiformis* and its effect on plant tissue. [Abstract.] *Nematologica*, 10 (1), 74.

3239—PRASAD, S. K. & WEBSTER, J. M., 1967. "Effect of temperature on the rate of development of *Nacobbus serendipiticus* in excised tomato roots." *Nematologica*, 13 (1), 85-90. [German summary p. 90.]

In experiments with excised roots, the life-cycle of *Nacobbus serendipiticus* took 36 days at 25°C. and 43 days at 20 or 30°C. Temperature also affected larval invasion, sex ratio and gall formation. Males were found in the galls. Gall formation was invariably associated with the development of the 3rd-stage females. No females produced eggs at 15°C. J.E.P.

3258—CLARK, S. A., 1967. "The development and life history of the false root-knot nematode, *Nacobbus serendipiticus*." *Nematologica*, 13 (1), 91-101. [German summary p. 100.]

Nacobbus serendipiticus has 4 moults, the first in the egg. Larvae may be sexed at the end of the 3rd stage. Damage to host roots by larval invasion is followed by necrosis of cortical cells. Galls contain a spindle-shaped mass of small cells containing starch. Of 25 plant species tested for susceptibility, mature females were recovered from *Beta vulgaris*, *Chenopodium album*, *Lactuca sativa*, *Lycopersicon esculentum*, *L. peruvianum*, *Solanum melongena*, *S. nigrum* and *Stellaria media*. J.E.P.

441—SCHUSTER, M. L., KERR, E. D. & SANDSTEDT, R., 1966. "The effect of six different soil temperatures on infection and development of *Nacobbus batatiformis* in sugar beets." *J. Am. Soc. Sug. Beet Technol.*, 14 (2), 174-179.

The inoculum potential of *Nacobbus batatiformis* on sugar beet was found to be small below a soil temperature of 15°C. but to increase up to 25°C. and to remain constant at and above this temperature. There was a direct relationship between the temperature, degree of root invasion and the observable symptoms on the host. J.B.

132—SHER, S. A., 1970. "Revision of the genus *Nacobbus* Thorne and Allen, 1944 (Nematoda: Tylenchoidea)." *J. Nematol.*, 2 (3), 228-235.

The genus *Nacobbus* is revised and its diagnosis emended. *N. dorsalis* and *N. aberrans* are redescribed and regarded as the only valid species in the genus. *N. batatiformis*, *N. serendipiticus* and *N. serendipiticus bolivianus* are proposed as synonyms of *N. aberrans*. M.R.S.

116—GOLDEN, A. M., 1971. "Classification of the genera and higher categories of the order Tylenchida (Nematoda)." In: Zuckerman, B. M.; Mai, W. F.; Rohde, R. A. [Editors], "Plant parasitic nematodes. Volume I. Morphology, anatomy, taxonomy, and ecology." New York: Academic Press, Inc., pp. 191-232.

The order Tylenchida is classified into 2 suborders, 6 superfamilies, 23 families, 46 subfamilies and 136 genera; diagnoses and differential keys for almost all these taxa are given. The suborder Tylenchina comprises these superfamilies: (i) Tylenchoidea containing Tylenchidae (with Tylenchinae, Psilenchinae, Ditylenchinae n.subf., Anguiniae, Dactylotylenchinae, Tylosorinae and Sychnotylenchinae n.rank), Tylenchorhynchidae n.rank (with Tylenchorhynchinae and Trophurinae), Dolichodoridae, Belonolaimidae n.rank (with Belonolaiminae and Telotylenchinae), Pratylenchidae (with Pratylenchinae and Radopholinae), Hoplolaimidae (with Hoplolaiminae, Rotylenchinae n.subf., Rotylenchoidinae and Aphasmatylenchinae); (ii) Heteroderoidea n.rank comprising Heteroderidae (with Heteroderinae, Meloidoderinae n.subf. and Meloidogyninae) and Nacobbidae n.rank (with Nacobbiniae and Rotylenchulinae); (iii) Criconematoidea consisting of Criconematidae (with Criconematinae and Hemicyclophorinae), Paratylenchidae and Tylenchulidae (with Tylenchulinae and Sphaeronematinae); (iv) Atylenchoidea n.rank with its type family and subfamily; and (v) Neotylenchoidea comprising Neotylenchidae, Paurodontidae (with Paurodontinae and Misticlinae), Nothotylenchidae (with Nothotylenchinae, Boleodorrinae and Halenchinae), Ecphyadophoridae, Sphaerulariidae, Myenchidae and Helionematidae. The suborder Aphelenchina comprises a single superfamily Aphelenchoidea which contains Aphelenchidae, Aphelenchoididae, Anomyctidae, and Paraphelenchidae. *Filenchus* and *Lelenchus* are synonymized with *Tylenchus* and so is *Tylenchus* (*Ottolenchus*) with *Aglenchus*. *Tylenchus* (*Ottolenchus*) *equisetus* Husain & Khan is synonymized with *T. (Aglenchus) parvus* Siddiqi which is proposed as *Aglenchus parvus* n.comb. *Cephalenchus* n.rank and *Cephalenchus hexalineatus* n.comb. are proposed for *Tylenchus* (*Cephalenchus*) and *T. (C.) hexalineatus*, respectively. *Tylenchorhynchus annulatus* (Cassidy) n.comb. is proposed for *Chitinotylenchus annulatus* (Cassidy) Filipjev based on the type specimens which are in the USDA Nematode Collection, Beltsville, Maryland. *Chitinotylenchoides mediterraneus* Arias & Jimenez, 1968 is considered a *nomen nudum*. Other new synonymies proposed include: *Tylenchus* (*Miculenchus*) and *T. (M.) salvus* syn. for *Miculenchus* and *M. salvus*, respectively; *Basiria magnidens* syn. for *Neopsilenchus magnidens*; *Basiria tumida* syn. for *Glavilenchus tumidus*; *Morulaimus hastulatus* syn. for *Telotylenchus hastulatus*; Hoplolaimoidea (Filipjev) Paramonov (in part) syn. for Tylenchina; Heteroderina (Filipjev) Skarbilovich (in part) syn. of Heteroderoidea; Criconematini (Taylor) Paramonov syn. for Criconematoidea. [See *Helminth. Abstr.*, Ser. B, 40, Nos. 135 & 657 for earlier proposals of Belonolaimidae n.rank and Sychnotylenchinae n.rank.] M.R.S.

1026—WEISCHER, B.; STEUDEL, W., 1972.
"Nematode diseases of sugar-beet." In: Webster,
J. M. [Editor], "Economic nematology." London,
UK: Academic Press. pp. 49-65. [En] Biologische
Bundesanstalt, Münster, Germany.

Aspects of the biology of *Heterodera schachtii*,
Ditylenchus dipsaci, *Meloidogyne*, *Nacobbus aberrans*,
Trichodorus and *Longidorus* as parasites of sugar-
beet, are described. Early sowing and suitable crop
rotation are the most efficient and economic ways to
avoid nematode damage, however many of the
nematodes are not specific and efficient weed control
is therefore essential. The economics of nematode
control on this industrial crop are discussed.
Radical changes in the production of sugar-beet
now under way will necessitate a more thorough
examination of aspects of nematodes as pests, if
intensive cropping is not to lead to severe outbreaks.

P.S.G.

1136—ALTMAN, J.; THOMASON, I., 1971.
"Nematodes and their control." In: Johnson,
R. T.; Alexander, J. T.; Rush, G. E.; Hawkes,
G. R. [Editors], "Advances in sugarbeet produc-
tion: principles and practices." Ames, Iowa,
U.S.A.: Iowa State University Press, pp. 335-
370. [En] Colorado State Univ., Fort Collins,
USA.

Of the 6 plant-parasitic nematodes important in
sugar-beet production, *Heterodera schachtii*,
Meloidogyne spp. and *Nacobbus aberrans* are the
major ones in USA. *Ditylenchus dipsaci* and
Longidorus spp. are not known as pests of sugar-beet
in USA; *Trichodorus* is known in a limited area.
The 6 nematodes are described and illustrated;
their life-histories, biology, pathogenicity and
world distribution are given, together with percent-
age economic loss in each country. Control
measures for each nematode are included, with
particular emphasis on *H. schachtii* for
which a table shows yields of roots and sugar
following soil fumigation with Telone at different
rates, on different dates and after different crop
rotations. A section on nematode control in general
briefly reviews agronomic practices, soil fumigation
and research to develop varieties resistant to
H. schachtii. So far no true resistance has been
found but a tolerance factor occurs in some selec-
tions of cultivated varieties of sugar-beet. M.T.F.

602 JOHNSON, J. D.; THAMES, W. H. The biology of a population
of *Nacobbus* (Hoplolaimidae: Nematoda) found parasitizing spinach in Texas.
[Abstract.] *Journal of Nematology* (1972) 4 (4) 228 [En] Dept. of Plant Sciences,
Texas A & M Univ., College Stn. 77843, USA.

[An unidentified *Nacobbus* with hosts in 5 plant families.]

779 JIMENEZ ROCO, M. [On the nematodes of Arica Department. (Part
Two).] Contribución al conocimiento de los nemátodos del Departamento de Arica.
(Segunda parte). *Idesia, Chile* (1972) No. 2, 53-58 [Es] Dept. de Agricultura, Univ.
del Norte, Arica, Chile.

Fifteen genera and 10 species of plant-parasitic nematodes are reported from a
survey of the Arica region, Chile. *Ditylenchus dipsaci* was found associated with
Medicago sativa and *Origanum vulgare*. *Nacobbus aberrans* from *O. vulgare* is new
to Chile and its biology and morphology are described. PSG

ANNOTATED BIBLIOGRAPHIES	Period covered	Number of References	Price	
			\$	£
1. <u>Cysticercus ovis</u> and <u>Taenia ovis</u>	1932-69	59	1.30	0.50
2. <u>Taenia saginata</u> and <u>T. solium</u> in Lebanon, Turkey and Yugoslavia	1932-69	50	1.30	0.50
3. Helminthology in Iraq	1932-69	71	1.80	0.70
4. Humpsore (Stephanofilariasis) in domestic animals	1932-69	71	1.80	0.70
5. Skin lesions in domestic animals caused by <u>Elaeophora</u> , <u>Rhabditis</u> & <u>Parafilaria</u>	1932-69	55	1.30	0.50
6. Helminths and plant nematodes of Morocco	1932-70	111	2.60	1.00
7. <u>Angiostrongylus</u>	1932-71	210	7.00	2.70
8. Factors influencing the development of <u>Ascaris</u> eggs	1932-71	120	3.10	1.20
9. Helminths in archaeological and pre-historic deposits	1910-72	32	1.30	0.50
0. Neurological involvement in <u>Trichinella spiralis</u> infection in man	1932-70	51	1.60	0.60
1. White tip disease (<u>Aphelenchoides besseyi</u>) of rice in Africa and the tropics	1913-72	150	6.20	2.40
2. Helminths in dogs in Japan	1960-72	89	2.60	1.00
3. Nematodes on soybean (<u>Glycine max</u>)	1932-72	184	5.70	2.20
4. <u>Oswaldocruzia</u> (Nematoda)	1930-73	29	1.30	0.50
5. Transmission of plant viruses by nematodes	1930-73	120	3.10	1.20
6. Plant nematology in Venezuela	1932-72	21	1.30	0.50
7. <u>Diorchis</u>	1931-72	46	3.10	1.20

These can be obtained from the Commonwealth Institute of Helminthology, The White House, 103 St. Peter's Street, St. Albans, Herts, England.

